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No. 4 of 1 series, Series A

K25RC

POWER REACTOR

NOT TO BE LOANED FROM
PLANT RECORDS K-1034

Excerpts from K-25 Plant Quarterly Reports
(K-636, K 637, K-638, and K-639)

FILE
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G 28394

Distribution

- 1-2. Technical Information Service, Oak Ridge, Tennessee
Attention: R. L. Morgan
3. Technical Division, K-1401 File
Attention: C. M. Preston
4. K-25 Plant Records Department

CLASSIFICATION CHANGED TO

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BY AUTHORITY OF TID-1381-S 12-31-71

BY *Phillips*

3-1-72

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PLANT RECORDS K-1034

CARBIDE AND CARBON CHEMICALS COMPANY
UNION CARBIDE AND CARBON CORPORATION
K-25 Plant
Oak Ridge, Tennessee

Carbide and Carbon Chemicals Corporation Operating
Contractor for the U.S. Atomic Energy Commission.

This document has been approved for release
to the public by

J. Phelan for A. S. Quist 1/24/96
Technical Information Officer Date
Oak Ridge K-25 Site

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This document contains restricted data as defined
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or the disclosure of its contents in any manner to
an unauthorized person is prohibited.

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TOWER REACTOR

Excerpts from K-25 Plant Quarterly Reports

K-636 - "K-25 Plant Quarterly Report for Fourth Fiscal Quarter, April 1-June 30, 1950"

Preliminary experiments have been made to investigate the conversion of uranium tetrafluoride to uranium hexafluoride in a tower type reactor. The reactor consists of a Monel pipe four inches in diameter by three feet high with appropriate feed and product withdrawal equipment. Uranium tetrafluoride, preheated to 700°F, was fed into the top of the tower together with a stream of undiluted fluorine and the reaction products were removed from the bottom of the tower. The uranium tetrafluoride particles burned when they came in contact with the fluorine as they dropped through the tower. Conversion efficiencies of between 75 and 85 per cent were obtained with a uranium tetrafluoride feed rate of thirty pounds per hour and a fluorine excess of 200 per cent over the stoichiometric quantity required.

K-637 - "K-25 Plant Quarterly Report for First Fiscal Quarter, July 1-September 30, 1950"

The reaction of uranium tetrafluoride with fluorine was studied in an experimental tower type reactor consisting of several sections of four-inch Monel pipe. Uranium tetrafluoride and fluorine were introduced at the top of the tower, and the uranium hexafluoride product and the ash were removed at the bottom of the tower. The effects of fluorine excess, fluorine concentration, uranium hexafluoride dilution, and tower length required for plant scale equipment were determined.

Conversion efficiencies exceeding 98.5% were obtained with feed rates of 50, 100, and 230 pounds of uranium tetrafluoride per hour and with outlet gas conditions comparable to those required for a uranium hexafluoride liquefaction system. With a tower length of five feet, a fluorine excess of 15 to 20%, and a fluorine concentration of ~ 75%, essentially complete conversion of uranium tetrafluoride to uranium hexafluoride was obtained. No apparent difference in reaction rate was noted when uranium hexafluoride rather than nitrogen was employed to dilute the fluorine gas.

K-638 - "K-25 Plant Quarterly Report for Second Fiscal Quarter, October 1-December 31, 1950"

A series of experimental tests were initiated to determine the feasibility of incorporating a clean-up section into the tower reactor. Fluorine was introduced both concurrent with and countercurrent to an excess of uranium tetrafluoride powder (at the expected powder to gas ratios for the Phase II feed plant operation) and although the fluorine gas was scrubbed efficiently, excessive uranium tetrafluoride powder carry-over made this solution to the fluorine clean-up problem impractical. A batch type fluorine clean-up reactor has been designed for testing.

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K-639 - "K-25 Plant Quarterly Report for Third Fiscal Quarter, January 1-March 31, 1951"

A series of experiments was conducted on the tower reactor pilot plant employing a six inch diameter by twelve foot long tower. A total of 47 experimental runs (table G-16) were performed with Mallinckrodt uranium tetrafluoride to optimize tower operating conditions with respect to (a) the method of uranium tetrafluoride introduction, (b) the nitrogen buffer requirements, (c) the fluorine concentration, (d) the fluorine excess, (e) the uranium tetrafluoride feed rate, and (f) the uranium tetrafluoride powder temperature.

Runs A-1 through A-28 represent tests in which the uranium tetrafluoride was discharged from a 1-1/4 inch feed screw and dropped through a one inch pipe into the tower. Although the conversion to uranium hexafluoride was increased by lengthening the one inch pipe section*, this system was less efficient than the original system** which employed a vibrating tray feeder between the feed screw and the tower. Thus, it was indicated that the primary factor affecting conversion was the degree of dispersion of the uranium tetrafluoride powder before it contacted the fluorine gas.

A vibrating baffle assembly (figure G-10) was then mounted between the feed screw and the tower and test runs A-29 to A-47 were made. The improved powder dispersion obtained in this system resulted in high conversion efficiencies with (a) a nitrogen buffer on the feed screw of 0.3 to 0.5 cfm., (b) a fluorine concentration of 38 to 85%, (c) a fluorine excess of 3 to 110%, (d) a feed rate of 193 to 346 pounds uranium tetrafluoride per hour, and (e) powder feed temperatures between 200°F. and 680°F.

*Runs A-1 through A-6 employed a seven inch length of pipe.

Runs A-7 through A-28 employed a thirty inch length of pipe.

**K-25 Plant Quarterly Report for Second Fiscal Quarter, October 1 - December 31, 1950 (K-638).

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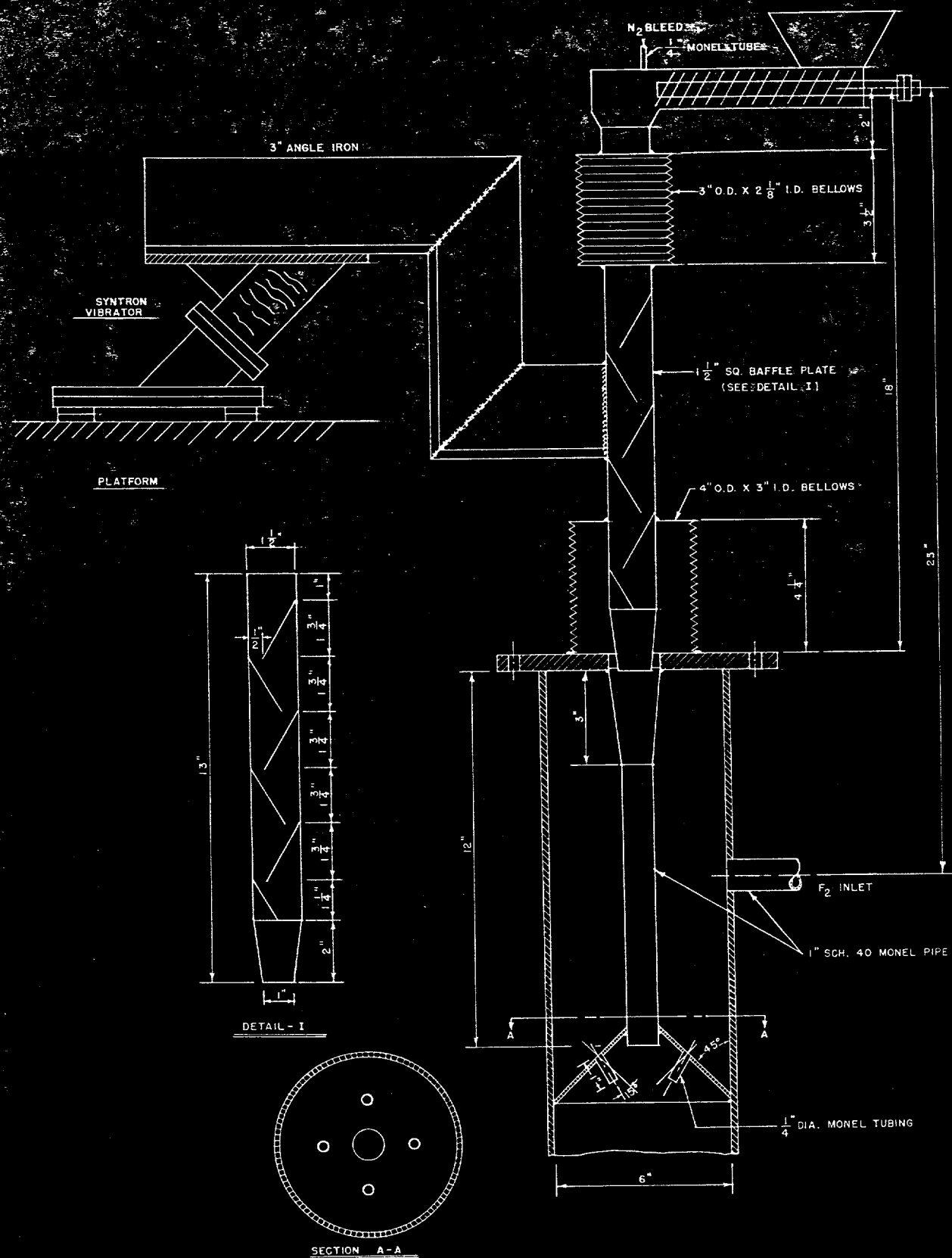
TABLE G-16

URANIUM TETRAFLUORIDE FLUORINATION RESULTS IN TOWER REACTOR PILOT PLANT

Run No.	UF ₄ Feed Lbs./Hr.	F ₂ Flow Lbs./Hr.	F ₂ Excess Percent	F ₂ Inlet Concentration Percent	UF ₆ Produced Lbs./Hr.	UF ₆ Temp., °F.	N ₂ Buffer Blended, Cfm.	Percent Conversion
A1	156	46.4	146	90*	138	980	0.5	78.6
A2	185.5	46.4	107	88.9	156	960	0.5	74.8
A3	191.4	33.9	46	85*	127	970	0.5	59.0
A4	201.6	26.9	10	80*	122	800	0.5	53.8
A5	123.6	38.8	159	82.6	104	675	0.5	74.9
A6	190.6	38.8	68	62.2	164	680	0.6	76.6
A7	206.7	39.4	58	85*	218	880	0.5	93.9
A8	184.9	37.1	66	85*	201	845	0.5	96.8
A9	188.8	22.1	Def.	66.9	167	940	0.5	78.9
A10	187.2	28.9	28	75.0	177	955	0.5	95.5
A11	181.0	34.2	56	74.3	179	945	0.5	84.3
A12	180.0	34.2	57	60.7	202	980	0.75	88.2
A13	171.2	43.4	110	85.2	158	1010	0.5	96.0
A14	225.6	42.6	56	85*	215	1040	0.5	82.4
A15	302.9	44.4	21	84.6	322	960	0.5	84.8
A16	272.1	47.9	46	87*	287	965	0.5	94.5
A17	282.3	41.4	21	84*	268	980	0.5	94.1
A18	252.5	53.3	74	84*	251	1005	0.5	84.7
A19	307.4	56.0	51	85.9	324	1015	0.5	88.7
A20	307.7	54.8	47	85*	311	1080	0.5	94.0
A21	82.3	55.2	454	85*	91	1050	0.7	90.2
A22	118.0	45.5	218	85*	127	1080	0.5	98.0
A23	227.9	55.6	101	85*	239	1040	0.5	95.4
A24	237	58.1	102	85*	259	1050	0.65	93.5
A25	205.5	45.5	83	85*	216	1050	0.75	97.5
A26	199.2	45.8	90	67.7	198	1030	1.33	93.6
A27	203.4	56.4	129	74.8	208	1000	1.0	88.7
A28	181.8	56.5	157	85*	195	1020	0.7	91.2
A29	194.8	49.4	110	85*	217	1020	0.5	95.7
A30	215.7	39.4	51	85*	239	990	0.5	99.4
A31	199.2	33.3	38	85*	220	980	0.3	98.6
A32	201.3	27.3	12	85*	214	605	0.2	98.5
A33	195.9	29.4	24	80.9	213	1005	0.2	94.8
A34	193.7	30.8	31	84.4	216	995	0.2	97.0
A35	192.9	28.6	23	91.8	186	1010	0.5	99.5
A36	251.8	36.8	21	85*	274	975	0.1	85.9
A37	257.0	39.1	26	85*	287	1010	0.5	97.1
A38	230.4	40.9	47	64	610	1055	0.5	99.6
A41	237.8	39.9	39	52.1	258	1050	0.5	99.9
A42	236.3	37.9	33	42.8	265	1000	0.5	99.7
A43	233.8	42.4	38	85.0	281	1030	0.5	100
A44	287.8	39.5	13	38.0	314	1035	0.5	98.8
A45	286.6	35.8	3	60.3	317	820	0.5	97.3
A46	289	40.6	16	52.3	625	760	0.5	98.7
A47	346	48.8	17	85.0	680	810	0.5	97.5
					383			98.8

*Estimated.

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VIBRATING BAFFLE ASSEMBLY FOR
TOWER REACTOR PILOT PLANT

FIGURE G-10

F1-2

CARBIDE AND CARBON CHEMICALS COMPANY

A DIVISION OF UNION CARBIDE AND CARBON CORPORATION

UCC

POST OFFICE BOX P
OAK RIDGE, TENN.

July 21, 1955

United States Atomic Energy Commission
Technical Information Service
Post Office Box 62
Oak Ridge, Tennessee

Attention: Mr. Robert L. Morgan, Chief
Technical Literature Section
Reference Branch

Gentlemen:

Tower Type Reactor

In accordance with your request TRT:RLM 7-24, dated July 14, 1955, transmitted herewith are two copies of memorandum number KLD-163. This memorandum consists of excerpts from K-25 Plant Quarterly Reports on the Tower Type Reactor.

Very truly yours,

CARBIDE AND CARBON CHEMICALS COMPANY

A. P. Huber
A. P. Huber, K-25 Plant Superintendent

APH:RCH:ejg

Attach: 2

cc: ✓ K-25 Plant Records
K25NoRC

KDD

TD Tower

8344

UNITED STATES
ATOMIC ENERGY COMMISSION

In Reply
Refer To: TRT:RIM 7-24

July 14, 1955

Mr. R. R. Lowery
Plant Records Department
Building K-1034, K-25
Carbide and Carbon Chemicals Company
P. O. Box P
Oak Ridge, Tennessee

Subject: TOWER TYPE REACTOR FOR PRODUCTION OF UF_6

Dear Mr. Lowery:

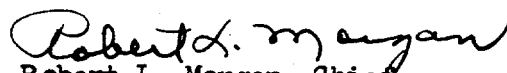
Argonne National Laboratory has requested information on the K-25 use of a tower type reactor for production of UF_6 for use in their feed materials work. Reference to this reactor is contained in K-636, Part I, pages 1 and 2.

A copy of the only specific report in our files pertinent to the request, KDD-307, has been forwarded to ANL.

We understand additional information on the reactor operation and design has been reported and may be included in the quarterly progress reports issued since K-636, Part I up to June 1952. We will appreciate copies of any additional reports or excerpts of the quarterly progress reports that would be of value to ANL in adapting the tower type to their feed materials work.

This request is a confirmation of a telephone conversation with W. C. Myers.

Very truly yours,


Robert L. Morgan, Chief
Technical Literature Section
Reference Branch

CC: A. P. Huber

Morgan:mp